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errors due to personality in right ascension depending on magnitude would be avoided.

It is to be remarked that this method is most useful for low latitudes; but that is precisely where the greatest difficulties are encountered in the other method.

It is also to be remarked that the method is *entirely* free from systematic instrumental error.

On the Change in the Errors of Hansen's Lunar Tables between 1848 *and* 1876. By W. T. Lynn, B.A. (London).

In the *Monthly Notices* for 1860, June 8 (vol. xx., p. 320), the Astronomer Royal gave a series of comparisons of places of the Moon derived from Burckhardt's and from Hansen's Lunar Tables, with places obtained from the Greenwich observations made with both the Transit Circle and the Altazimuth instruments, for the years from 1847 to 1858. The result showed, as is well known, an immense superiority during that time of Hansen's over Burckhardt's Tables; but an impression has gained ground that the former have not in more recent years represented the Moon's place nearly so well as they did at that period. I have thought it worth while to calculate for one recent year the sums of the squares of the Moon's errors deduced from comparing the *Nautical Almanac* places (derived from Hansen's Tables) with those obtained from the Greenwich observations, and to compare them with those of one of the earlier years, the results of which were furnished by the Astronomer Royal. In doing so, I have selected the year 1876 as the last of which the Greenwich observations have been published, and compared its results with those of 1848, the earliest in which Altazimuth observations were made throughout the year. These years are separated by an interval of twenty-eight years, and the sums of the squares of the errors in longitude and ecliptic north polar distance are as follows:—

1. *From Observations with the Transit Circle.*

Year.	No. of Obs.	Sums of Squares of Errors of Longitude. ″	Sums of Squares of Errors of E.N.P.D. ″
1848	113	1132·64	810·21
1876	82	8433·37	466·88

2. *From Observations with the Altazimuth.*

Year.	No. of Obs.	Sums of Squares of Errors of Longitude. ″	Sums of Squares of Errors of E.N.P.D. ″
1848	199	2567·76	1989·89
1876	171	17605·94	1696·33

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This comparison seems to show that, whilst the error of E.N.P.D. has not altered to the extent, at any rate, of being of a different order of magnitude (that it is somewhat smaller in 1876 being probably chiefly due to the smaller number of observations of that year), the error of longitude has, on the other hand, increased so much that the sum of the squares of the errors with each instrument was in 1876 about seven times as great as it was in 1848.

To determine whether the above increase in the sums of the squares of the errors in longitude is principally due to greater fluctuations in the error on different days, or to progressive change in the mean error for different years, I have calculated the value of the mean error for the above years, and for the year midway between them, i.e. 1862,* with the following result. (It is to be remarked that the errors of Hansen's Tables for 1848 are given, with those of later years for which the *Nautical Almanac* places were from Burckhardt's, at the end of the *Greenwich Observations* for 1859. All the errors are set down in the nature of excess of tabular over observed.)

1. *From Observations with the Transit Circle.*

Year.	No. of Obs.	Mean Error in Longitude for the Year.
		″
1848	113	+0·19
1862	85	−2·83
1876	82	+9·72

2. *From Observations with the Altazimuth.*

Year.	No. of Obs.	Mean Error in Longitude for the Year.
		″
1848	199	+1·90
1862	166	−3·55
1876	171	+9·31

These numbers indicate very clearly remarkable changes in the mean error in longitude of Hansen's Tables, which, almost insignificant at the commencement of the period here referred to, or about thirty years ago, first changed its sign (still continuing small) a few years afterwards, and subsequently to that again changed its sign and increased considerably in magnitude, to which increase that of the sums of the squares of the errors mentioned above is evidently principally due.

Some years ago, Professor Newcomb published, in the *American Journal of Science and Arts* (Number for September 1870, Second Series, vol l., p. 183), a paper entitled "Considerations on the

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* 1862 is the first year in which the *Nautical Almanac* used Hansen's Tables.

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Apparent Inequalities of Long Period in the Mean Motion of the Moon," in which he gives (page 191) a similar comparison of the mean errors of the longitude in different years, both from the Greenwich and Washington observations, but limiting the former (which terminate in 1868, whilst the Washington extend one year further) to those made on the meridian, or with the Transit Circle. In comparing this with the results above, it will be noticed that Professor Newcomb gives his errors in the nature of excess of observed over tabular place, or of apparent correction applicable to the tables. Within their respective limits our results are mutually to a great extent confirmatory. Professor Newcomb commences his comparison with the year 1850, in which the error in longitude, both from Greenwich and Washington observations, is very small. In 1862 the mean error from both Greenwich and Washington is about $-2\frac{1}{2}''$ for excess of tabular over observed place (as always set down in the *Greenwich Observations*). In 1868, the last year for which Professor Newcomb gives the Greenwich error (derived only from the observations of the principal observers), that and the Washington error are both about $+4\frac{1}{2}''$, whilst in 1869, for which he gives the mean error derived from the Washington observations only (those made at Greenwich being not accessible to him at the time of the publication of his paper), that error amounts to $5\frac{1}{2}''$. In 1876, as we have seen, the mean error deduced from the Greenwich observations was approaching $10''$, equivalent to two-thirds of a second of time.

I have had the curiosity to compute the mean error in longitude of Burckhardt's Tables for 1848. The Transit Circle observations, 113 in number, give $+7''\cdot87$; the Altazimuth, 199 in number, give $+8''\cdot68$. The sums of the squares are furnished in the Astronomer Royal's paper before referred to; they are, for the Transit Circle, 7662·82, and for the Altazimuth 18880·81. Hansen's Tables therefore do not appear to represent the Moon's place better in 1876 than Burckhardt's in 1848. The latter, it will be remembered, were published in 1812; and the author mentions in the preface that their superiority over those of Bürg (published in 1806) had been shown, in that a comparison of 167 observations made at Greenwich and Paris with places from his own Tables gave the sum of the squares of the errors in longitude only about two-thirds of that obtained from a similar comparison with places from Bürg's Tables, besides diminishing the sum of the squares of the errors in latitude.